RIPv2

Routing Protocols and Concepts – Chapter 7

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Version 4.0

Objectives

- Encounter and describe the limitations of RIPv1's limitations.
- Apply the basic Routing Information Protocol Version 2 (RIPv2) configuration commands and evaluate RIPv2 classless routing updates.
- Analyze router output to see RIPv2 support for VLSM and CIDR.
- Identify RIPv2 verification commands and common RIPv2 issues.
- Configure, verify, and troubleshoot RIPv2 in "hands-on" labs.

Introduction

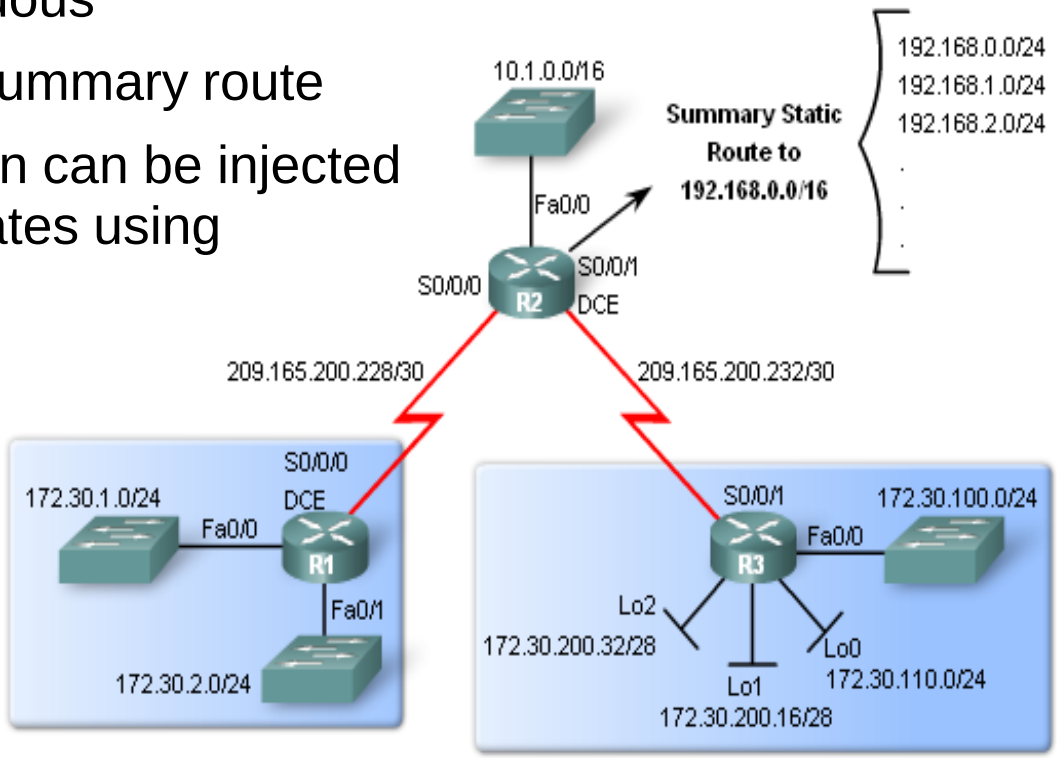
- Chapter focus
  - Difference between RIPv1 & RIPv2
    - RIPv1
      - A classful distance vector routing protocol
      - Does not support discontiguous subnets
      - Does not support VLSM
      - Does not send subnet mask in routing update
      - Routing updates are broadcast
    - RIPv2
      - A classless distance vector routing protocol that is an enhancement of RIPv1's features
      - Next hop address is included in updates
      - Routing updates are multicast
      - The use of authentication is an option

Introduction

- Similarities between RIPv1 & RIPv2
  - Use of timers to prevent routing loops
  - Use of split horizon or split horizon with poison reverse
  - Use of triggered updates
  - Maximum hop count of 15

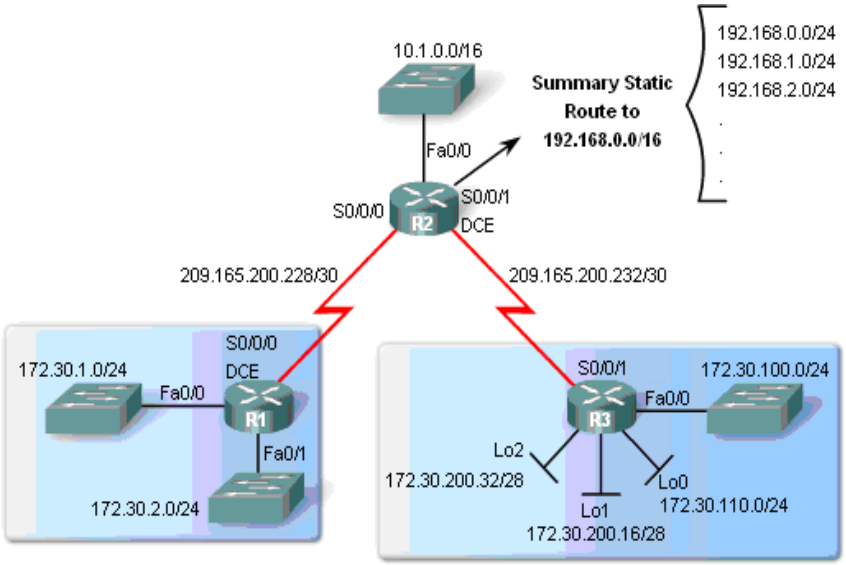
RIPv1 Limitations

- Lab Topology
- Scenario:
  - 3 router set up
  - Topology is discontiguous
  - There exists a static summary route
  - Static route information can be injected into routing table updates using redistribution
  - Routers 1 & 3 contain VLSM networks



RIPv1 Limitations

- Scenario Continued
- VLSM
  - Recall this is sub netting the subnet
- Private IP addresses are on LAN links
- Public IP addresses are used on WAN links
- Loopback interfaces
  - These are virtual interfaces that can be pinged and added to routing table



RFC 1918 Private Addresses

Class	Prefix/Mask	Address Range
A	10.0.0.0/8	10.0.0.0 to 10.255.255.255
B	172.16.0.0/12	172.16.0.0 to 172.31.255.255
C	192.168.0.0/16	192.168.0.0 to 192.168.255.255

Used for private IP addressing

Cisco Example IP Addresses

Prefix/Mask	Address Range
209.165.200.224/27	209.165.200.224 to 209.165.200.255
209.165.201.0/27	209.165.201.0 to 209.165.201.31
209.165.202.128/27	209.165.202.128 to 209.165.202.159

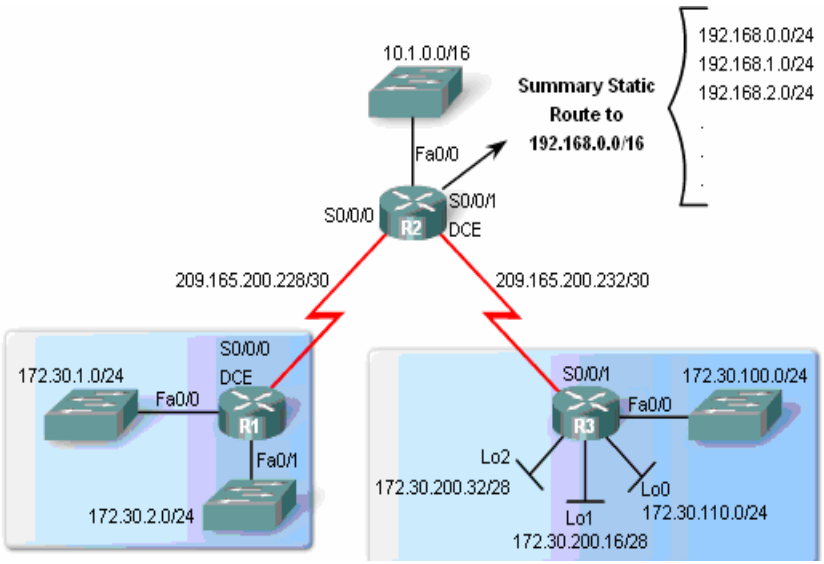
Used for public IP addressing when needed for example purposes.

RIPv1 Limitations

- **Null Interfaces**
  - This is a virtual interface that does not need to be created or configured
    - Traffic sent to a null interface is discarded
    - Null interfaces do not send or receive traffic
- **Static routes and null interfaces**
  - Null interfaces will serve as the exit interface for static route
    - Example of configuring a static supernet route with a null interface
    - R2(config)#ip route 192.168.0.0 255.255.0.0 Null0

RIPv1 Limitations

- **Route redistribution**
  - Redistribution command is way to disseminate a static route from one router to another via a routing protocol
  - Example
    - R2(config-router)#redistribute static



Additional RIPv1 Configurations

```
R1(config)#router rip
R1(config-router)#network 172.30.0.0
R1(config-router)#network 209.165.200.0
```

```
R2(config)#ip route 192.168.0.0 255.255.0.0 null0
R2(config)#router rip
R2(config-router)#redistribute static
R2(config-router)#network 10.0.0.0
R2(config-router)#network 209.165.200.0
```

Static route configured and redistributed.

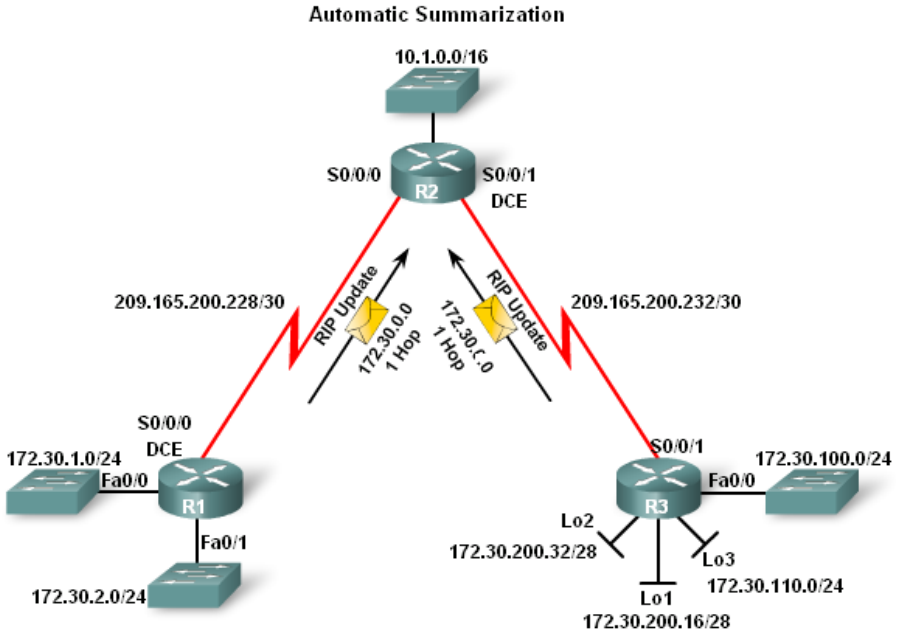
```
R3(config)#router rip
R3(config-router)#network 172.30.0.0
R3(config-router)#network 209.165.200.0
```

RIPv1 Limitations

- Verifying and Testing Connectivity
  - Use the following commands:
    - show ip interfaces brief
    - ping
    - traceroute

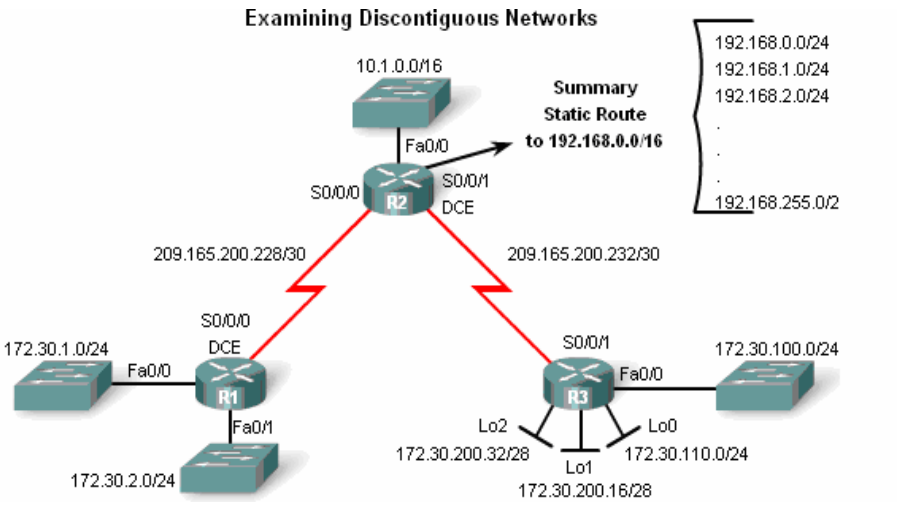
RIPv1 Limitations

- **RIPv1 –** a classful routing protocol
  - Subnet mask **are not sent** in updates
  - Summarizes networks at major network boundaries
  - If network is discontiguous and RIPv1 configured convergence will not be reached



RIPv1 Limitations

- **Examining the routing tables**
  - To examine the contents of routing updates use the ***debug ip rip*** command
  - If RIPv1 is configured then Subnet masks will not be included with the network address



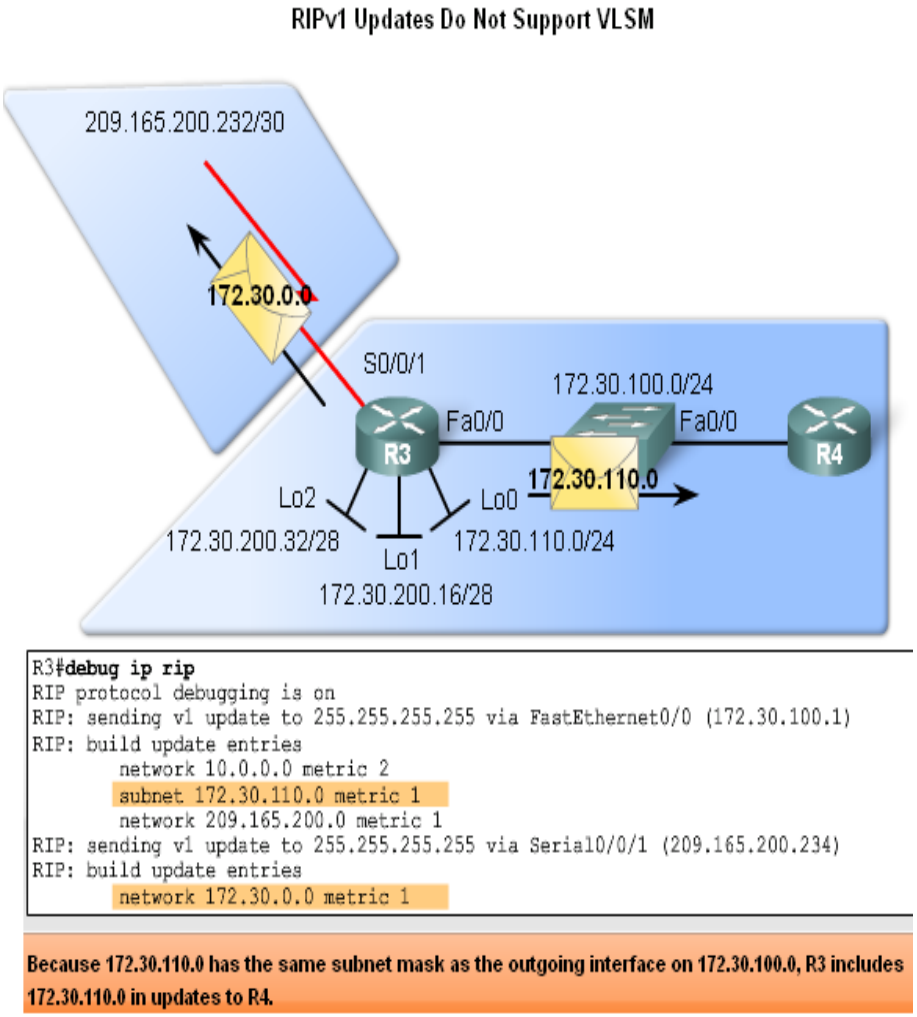
R2 is not advertising 172.30.0.0 to R1 or R3.

```
R2#debug ip rip
RIP protocol debugging is on

RIP: received v1 update from 209.165.200.230 on Serial0/0/0
     172.30.0.0 in 1 hops
RIP: received v1 update from 209.165.200.234 on Serial0/0/1
     172.30.0.0 in 1 hops
R2#
RIP: sending v1 update to 255.255.255.255 via Serial0/0/0 (209.165.200.229)
RIP: build update entries
        network 10.0.0.0 metric 1
        subnet 209.165.200.232 metric 1
RIP: sending v1 update to 255.255.255.255 via Serial0/0/1 (209.165.200.233)
RIP: build update entries
        network 10.0.0.0 metric 1
        subnet 209.165.200.228 metric 1
```

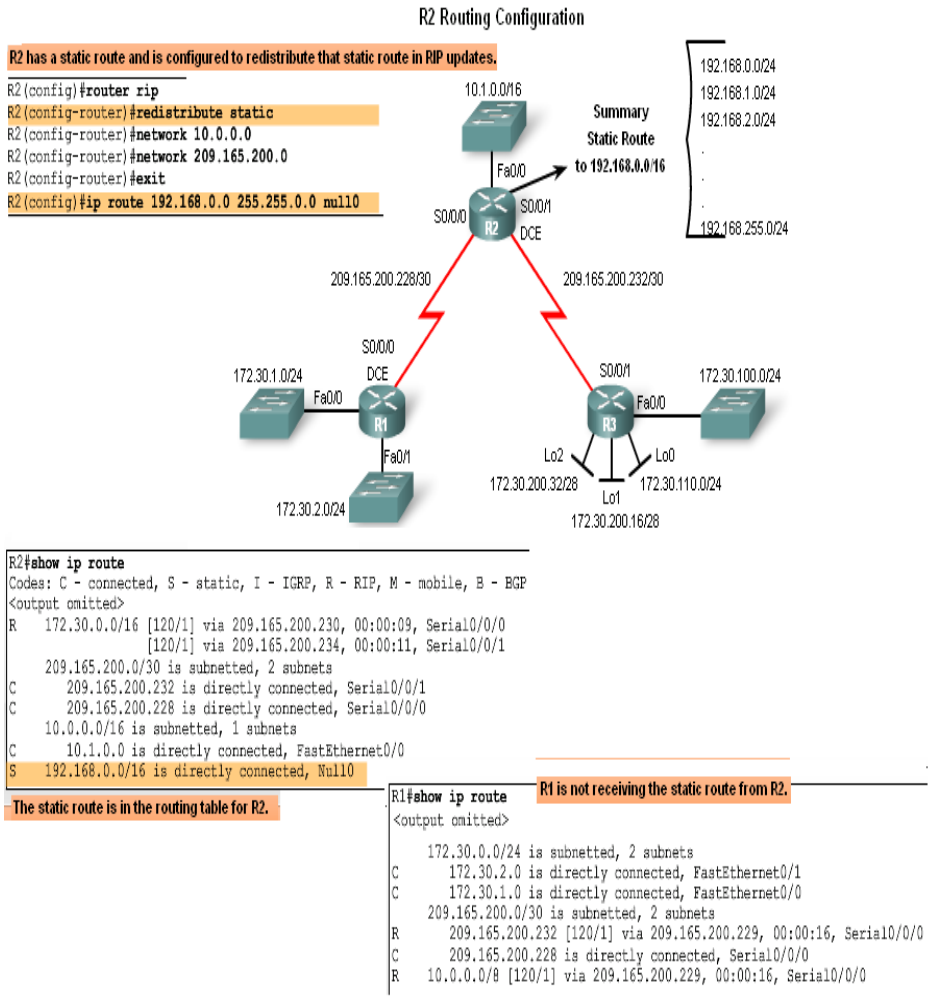
RIPv1 Limitations

- RIPv1 does not support VLSM
  - Reason: RIPv1 does not send subnet mask in routing updates
- RIPv1 does summarize routes to the Classful boundary
  - Or uses the Subnet mask of the outgoing interface to determine which subnets to advertise



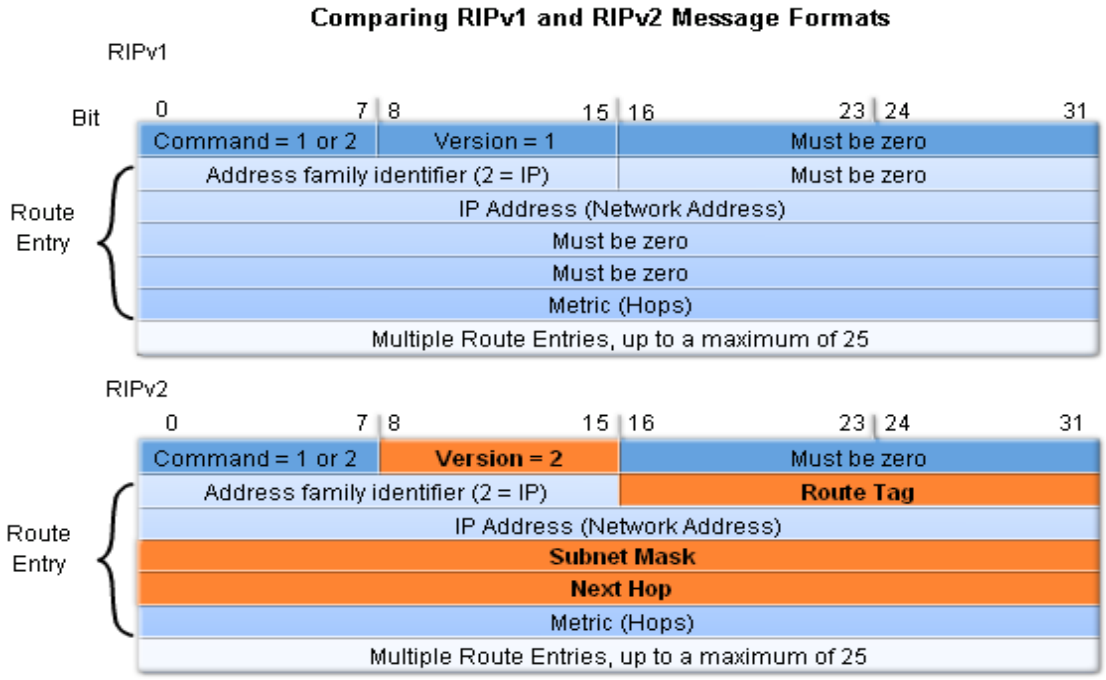
RIPv1 Limitations

- No CIDR Support
- In the diagram R2 will not include the static route in its update
  - Reason: Classful routing protocols do not support CIDR routes that are summarized with a smaller mask than the classful subnet mask



Configuring RIPv2

- **Comparing RIPv1 & RIPv2 Message Formats**
  - RIPv2 Message format is similar to RIPv1 but has 2 extensions
    - 1st extension is the subnet mask field
    - 2nd extension is the addition of next hop address

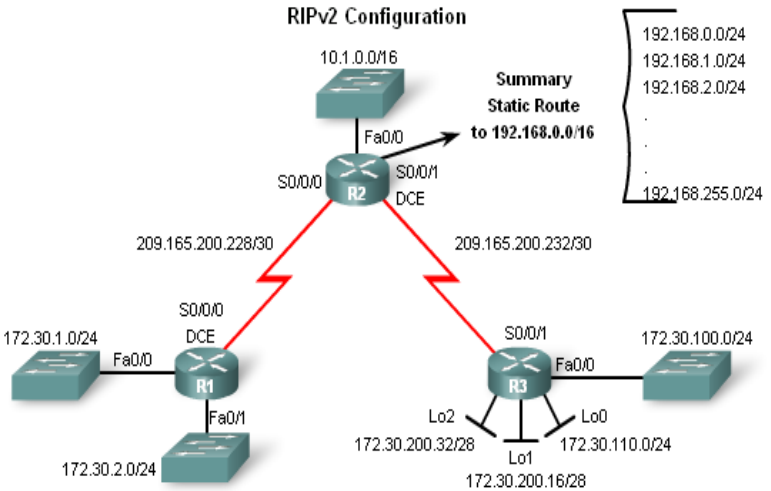


Configuring RIPv2

- Enabling and Verifying RIPv2
- Configuring RIP on a Cisco router
  - By default it is running RIPv1

Configuring RIPv2

- Configuring **RIPv2** on a Cisco router
  - Requires using the ***version 2*** command
  - RIPv2 ignores RIPv1 updates
- To verify RIPv2 is configured use the
  - ***show ip protocols*** command




```
R1(config)#router rip
R1(config-router)#version 2
```

```
R2(config)#router rip
R2(config-router)#version 2
```

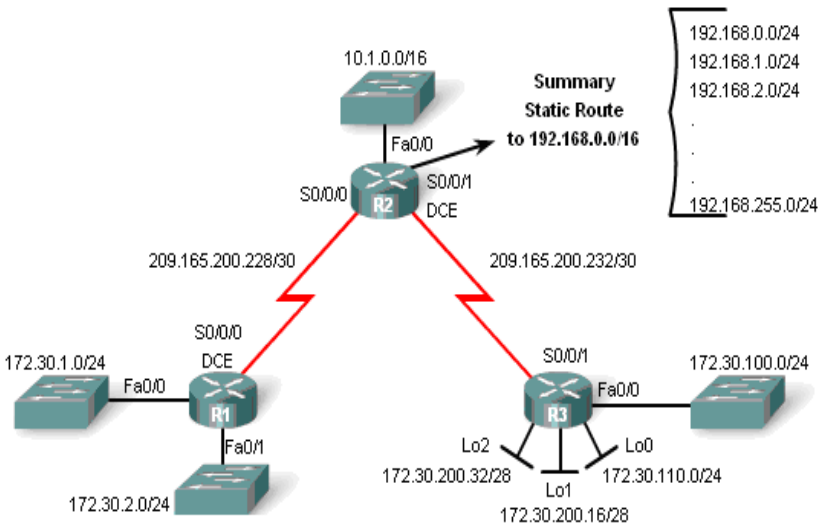
```
R3(config)#router rip
R3(config-router)#version 2
```

R2 After RIPv2 Configuration: RIPv2 ignores RIPv1 updates

```
R2#show ip protocols
Routing Protocol is "rip"
  Sending updates every 30 seconds, next due in 1 seconds
  Invalid after 180 seconds, hold down 180, flushed after 240
  Outgoing update filter list for all interfaces is
  Incoming update filter list for all interfaces is
  Redistributing: static, rip
  Default version control: send version 2, receive version 2
    Interface              Send  Recv  Triggered RIP  Key-chain
    Serial0/0/0            2     2
    Serial0/0/1            2     2
  Automatic network summarization is in effect
  Routing for Networks:
    10.0.0.0
    209.165.200.0
  Passive Interface(s):
    FastEthernet0/0
  Routing Information Sources:
    Gateway         Distance      Last Update
    209.165.200.234         120         00:00:03
    209.165.200.230         120         00:00:17
  Distance: (default is 120)
```

Configuring RIPv2

- Auto-Summary & RIPv2
- RIPv2 will automatically summarize routes at major network boundaries and can also summarize routes with a subnet mask that is smaller than the classful subnet mask




```
R1#show ip route                          R1 now has supernet.

Gateway of last resort is not set

     172.30.0.0/24 is subnetted, 2 subnets
C       172.30.2.0 is directly connected, Loopback0
C       172.30.1.0 is directly connected, FastEthernet0/0
     209.165.200.0/30 is subnetted, 2 subnets
R       209.165.200.232 [120/1] via 209.165.200.229, 00:00:04, Serial0/0/0
C       209.165.200.228 is directly connected, Serial0/0/0
R    10.0.0.0/8 [120/1] via 209.165.200.229, 00:00:04, Serial0/0/0
R    192.168.0.0/16 [120/1] via 209.165.200.229, 00:00:04, Serial0/0/0
```

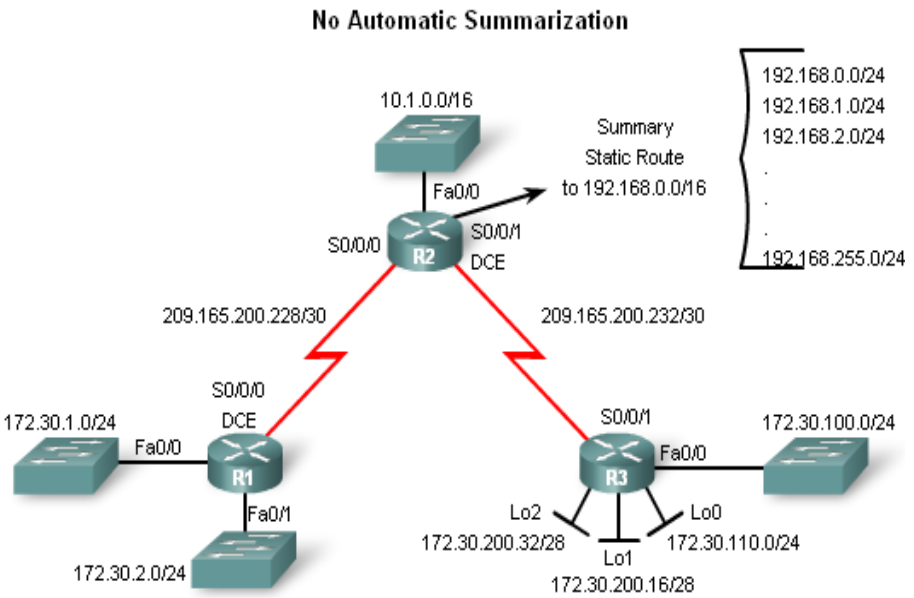
```
R1#debug ip rip                           R1 still sending summary route but now with subnet mask /16.
RIP protocol debugging is on
R1#
RIP: sending v2 update to 224.0.0.9 via Serial0/0/0 (209.165.200.230)
RIP: build update entries
        172.30.0.0/16 via 0.0.0.0, metric 1, tag 0
R1#
<output omitted for brevity>
RIP: received v2 update from 209.165.200.229 on Serial0/0/0
     10.0.0.0/8 via 0.0.0.0 in 1 hops
     192.168.0.0/16 via 0.0.0.0 in 1 hops
     209.165.200.232/30 via 0.0.0.0 in 1 hops
<output omitted for brevity>
```

```
R1#show ip protocols                      show ip protocols command verifies auto summarization.
Routing Protocol is "rip"
  Sending updates every 30 seconds, next due in 20 seconds
  Invalid after 180 seconds, hold down 180, flushed after 240
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Redistributing: rip
  Default version control: send version 2, receive version 2
    Interface             Send  Recv  Triggered RIP  Key-chain
    FastEthernet0/0       2     2
    FastEthernet0/1       2     2
    Serial0/1/0           2     2
  Automatic network summarization is in effect
  Maximum path: 4
```

```
R1#debug ip rip                           Supernets are now included in RIPv2 updates.
RIP protocol debugging is on
R1#
RIP: sending v2 update to 224.0.0.9 via Serial0/1/0 (209.165.200.230)
RIP: build update entries
        172.30.0.0/16 via 0.0.0.0, metric 1, tag 0
R1#
<output omitted for brevity>
RIP: received v2 update from 209.165.200.229 on Serial0/1/0
     10.0.0.0/8 via 0.0.0.0 in 1 hops
     192.168.0.0/16 via 0.0.0.0 in 1 hops
     209.165.200.232/30 via 0.0.0.0 in 1 hops
<output omitted for brevity>
```

Configuring RIPv2

- Disabling Auto-Summary in RIPv2
- To disable automatic summarization issue the *no auto-summary* command




```
R1(config)#router rip
R1(config-router)#no auto-summary
R1(config-router)#end
R1#show ip protocols
Routing Protocol is "rip"
<output omitted for brevity>
  Default version control: send version 2, receive version 2
    Interface              Send  Recv  Triggered RIP  Key-chain
    FastEthernet0/0        2     2
    FastEthernet0/1        2     2
    Serial0/1/0            2     2
  Automatic network summarization is not in effect
  <output omitted for brevity>
```

```
R2(config)#router rip
R2(config-router)# no auto-summary
```

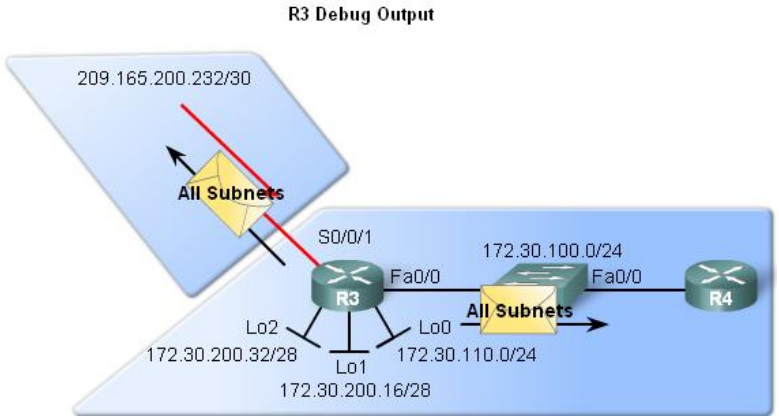
```
R3(config)#router rip
R3(config-router)#no auto-summary
```

Configuring RIPv2

- Verifying RIPv2 Updates
- When using RIPv2 with automatic summarization turned off
  - Each subnet and mask has its own specific entry, along with the exit interface and next-hop address to reach that subnet
- To verify information being sent by RIPv2 use the
  - *debug ip rip* command

VLSM & CIDR

- RIPv2 and VLSM
- Networks using a VLSM IP addressing scheme
  - Use classless routing protocols (i.e. RIPv2) to disseminate network addresses and their subnet masks



R3 Debug Output

```
R3#debug ip rip
RIP protocol debugging is on
R3#
RIP: received v2 update from 209.165.200.233 on Serial0/0/1
     10.1.0.0/16 via 0.0.0.0 in 1 hops
     172.30.1.0/24 via 0.0.0.0 in 2 hops
     172.30.2.0/24 via 0.0.0.0 in 2 hops
     192.168.0.0/16 via 0.0.0.0 in 1 hops
     209.165.200.228/30 via 0.0.0.0 in 1 hops
R3#
RIP: sending v2 update to 224.0.0.9 via FastEthernet0/0 (172.30.100.1)
RIP: build update entries
        10.1.0.0/16 via 0.0.0.0, metric 2, tag 0
        172.30.1.0/24 via 0.0.0.0, metric 3, tag 0
        172.30.2.0/24 via 0.0.0.0, metric 3, tag 0
        172.30.110.0/24 via 0.0.0.0, metric 1, tag 0
        172.30.200.16/28 via 0.0.0.0, metric 1, tag 0
        172.30.200.32/28 via 0.0.0.0, metric 1, tag 0
        192.168.0.0/16 via 0.0.0.0, metric 2, tag 0
        209.165.200.228/30 via 0.0.0.0, metric 2, tag 0
        209.165.200.232/30 via 0.0.0.0, metric 1, tag 0
RIP: sending v2 update to 224.0.0.9 via Serial0/0/1 (209.165.200.234)
RIP: build update entries
        172.30.100.0/24 via 0.0.0.0, metric 1, tag 0
        172.30.110.0/24 via 0.0.0.0, metric 1, tag 0
        172.30.200.16/28 via 0.0.0.0, metric 1, tag 0
        172.30.200.32/28 via 0.0.0.0, metric 1, tag 0
```

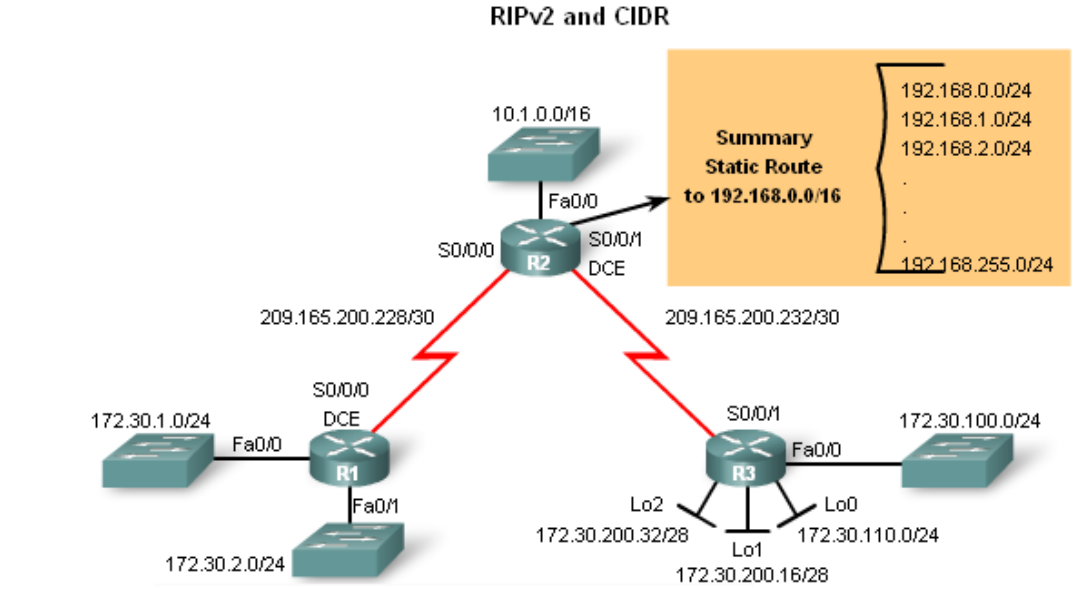
RIPv2 supports VLSM

VLSM & CIDR

- CIDR uses Supernetting
  - Supernetting is a bunch of contiguous classful networks that is addressed as a single network

VLSM & CIDR

- To **verify** that **supernets** are being sent and received use the following commands
  - Show ip route
  - Debug ip rip



RIPv2 and CIDR

```
R2(config)#router rip
R2(config-router)#redistribute static
R2(config-router)#network 10.0.0.0
R2(config-router)#network 209.165.200.0
R2(config-router)#exit
R2(config)#ip route 192.168.0.0 255.255.0.0 null0
```

192.168.0.0/16 is a Supernet.

```
R2#debug ip rip
RIP protocol debugging is on
R2#
RIP: sending v2 update to 224.0.0.9 via Serial0/0/0 (209.165.200.229)
RIP: build update entries
       10.1.0.0/16 via 0.0.0.0, metric 1, tag 0
       172.30.100.0/24 via 0.0.0.0, metric 2, tag 0
       172.30.110.0/24 via 0.0.0.0, metric 2, tag 0
       172.30.200.16/28 via 0.0.0.0, metric 2, tag 0
       172.30.200.32/28 via 0.0.0.0, metric 2, tag 0
       192.168.0.0/16 via 0.0.0.0, metric 1, tag 0
       209.165.200.232/30 via 0.0.0.0, metric 1, tag 0
```

Supernet is sent by R2.

Verifying & Troubleshooting RIPv2

- **Basic Troubleshooting** steps
  - Check the status of all links
  - Check cabling
  - Check IP address & subnet mask configuration
  - Remove any unneeded configuration commands
- Commands used to verify proper operation of RIPv2
  - Show ip interfaces brief
  - Show ip protocols
  - Debug ip rip
  - Show ip route

Verifying & Troubleshooting RIPv2

- Common RIPv2 Issues
- When trouble shooting RIPv2 examine the following issues:
  - Version
    - Check to make sure you are using version 2
  - Network statements
    - Network statements may be incorrectly typed or missing
  - Automatic summarization
    - If summarized routes are not needed then disable automatic summarization

Verifying & Troubleshooting RIPv2

- Reasons why it's good to authenticate routing information
  - Prevent the possibility of accepting invalid routing updates
  - Contents of routing updates are encrypted
- Types of routing protocols that can use authentication
  - RIPv2
  - EIGRP
  - OSPF
  - IS-IS
  - BGP

Summary

Routing Protocol	Distance Vector	Classless Routing Protocol	Uses Hold-Down Timers	Use of Split Horizon or Split Horizon w/ Poison Reverse	Max Hop count = 15	Auto Summary	Support CIDR	Supports VLSM	Uses Authen-tication
RIPv1	Yes	No	Yes	Yes	Yes	Yes	No	No	No
RIPv2	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes